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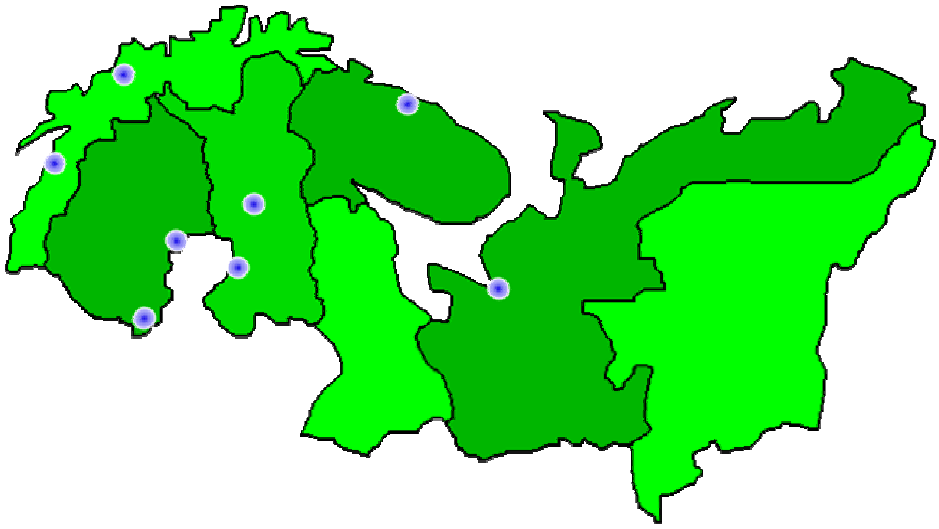
Feasibility Study for a Barents Transport Flow Model / Database

Feasibility Study for a
Barents Transport Flow Model /Database



STBR

Preface

This working paper is based on preliminary findings in the Barents Region (STBR) project Sustainable Transport sub project “Feasibility Study for a Barents Transport Flow Model /Database”.

Cross border transport is not properly included in the different national Transport Flow Models and Databases of the Barents region. Therefore, the relative importance of these international flows is neglected when calculating the flows on each national transport network.

In regional project appraisals, the benefits from these international flows will be underestimated and the relative importance of investments into transport networks in the Barents Region will be held back compared to other investments in each country.

Therefore, databases and modelling tools need to be developed with arguments for such developments being presented in this working paper .

By establishing a database and modelling tools for the specific condition, establishment of Sustainable Transport in the Barents Region is one step further.

This working paper has been produced by Glenn Berggård, Division of Architecture and Infrastructure, Department of Environmental Engineering, Luleå University of Technology

Summary

Experiences from the Sustainable Transport in the Barents Region (STBR) project and other ongoing projects show the specific conditions in the northern parts of the participating Barents region countries to be not well considered in either the modelling tools or the databases.

The national transport models are only somewhat useful, at present, in analysing the cross border and specific Barents region regional transport flows.

There is a need for a model capable of handling specific situations in the region, such as:
-Seasonal variations
-Loose networks
-Countries with different development and political backgrounds
-Special destinations
-Handling of goods

A Barents transport database (BTD) should be based on such a structure so as to be integrated with the national databases in Sweden, Norway, Finland and Russia. The database should be basically a virtual database based on already existing databases and include traditional data as well as data found in the STBR project and other later defined important data.

The establishment of the database should start with the road infrastructure and include the infrastructure for other transport modes later on.

Benefits from the use of existing transport flow models in the region are mainly based on the experiences from using the models for domestic comparisons of different objects in the investment planning process. A Barents Transport Analysis Tool (BTAT) should be developed based on existing national models in Sweden, Norway and Finland. The specific modules, or adoptions of existing modules, for each existing national model of special interest in the region, should be developed in a cross-country organised project.

Development of the BTAT should be made as complementary modules to the already existing tools used in each of the countries. Particular Barents functionality shall be specified jointly. Development of the complementary modules shall therefore be made for each of the national models in the Barents region.

Analyzing seasonal variations, in particular, should be of importance.

Opportunities to create scenarios, and analyze the consequences of such scenarios, are also vital. Cross border transport flow analyses specifically considering the conditions of the Barents region shall be included.

Content list

1. Background

Experiences from the Sustainable Transport in the Barents Region (STBR) project and, especially, the subprojects Study on passengers flows in the Barents Region and Study on freight flows in the Barents Region as well as other ongoing projects show the specific conditions in the northern parts of the participating Barents region countries to not be well considered, in either the modelling tools or the databases.

The Barents Region includes parts of the EU member states Finland and Sweden along with parts of Norway and Russia (See Appendix 1)

There are specific Northern, or should one say, specific Barents Dimensions:

-Sparsely populated areas/low density and therefore, low traffic flows

-Nordic climate with large seasonal variations

-A dominating heavy industry/basic industry

In Europe, the Barents region dominates in mining, forestry and future oil and natural gas. The seafood industry is also of importance for the Barents region.

To use these natural resources and overcome these regional conditions, databases and modelling tools have to include these Barents Dimensions.

Existing and planned development of models and databases in the EU and countries participating in the STBR are ongoing, e.g.:

*Trans-Tools are developed during 2004-2006 with the aim of including:

- Intermodality for passenger/freight (as National and European transport policies seek to promote intermodality through different measures).
- Inclusion of intercontinental flows (mainly for freight), as some models do not cover this segment.
- Full coverage of Central and Eastern Europe (Accession Countries and the countries on the borders of the enlarged European Union).
- Integration of the new Member States at a level similar to those of EU 15.
- Feedback infrastructure development-economy (as the question of indirect effects in the economy and on network level is important, especially where investment has a substantial influence - notably for the Accession Countries).
- Logistics/freight chain explicitly included.
- Coupling method with local traffic to address the effect of congestion on long-distance traffic.

- A software approach is chosen resulting in a software modelling tool on a network level

*The Norwegian freight model NEMO is further developed and will improve in a few years.

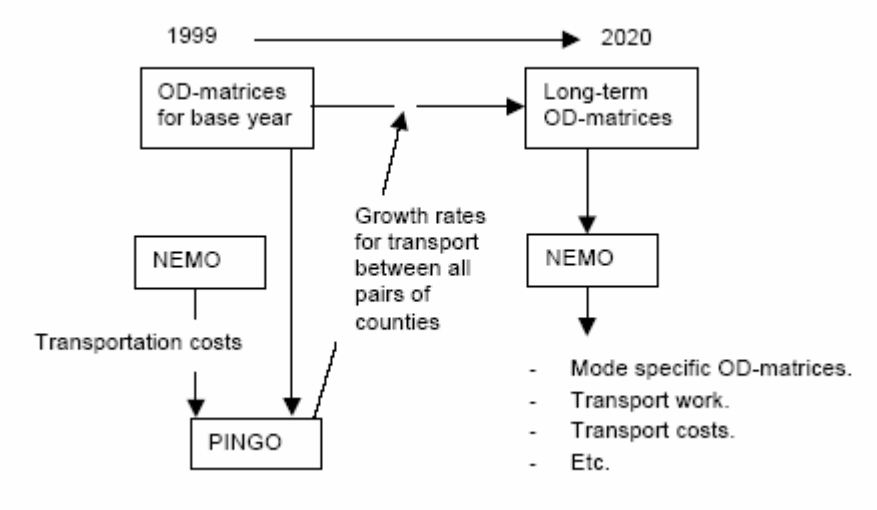


Figure 1. A schematic view of the interplay between NEMO and PINGO. (From TÖI report 578/2002).

* Swedish and Norwegian authorities have produced in a project a specification of a logistics model as part of the Norwegian and Swedish national freight model systems. The national model systems for freight transport in both countries lack logistic elements (such as the use of distribution centres). The report contains the outcomes of a project to specify how a new logistics module for these model systems could look like, including both the scope and structure of a logistics model as well as an implementation plan.
The report was made for freight transport modellers interested in including logistics into (national) freight transport planning models, in particular the Norwegian and Swedish national model systems for freight transport. This collaboration will continue in 2006.

Development of databases is ongoing. For instance:

* The European Union territorial units for statistics are divided into different regional areas. There are 89 regions at NUTS level 1, 254 at NUTS level 2 and 1,214 at NUTS level 3. The areas covered by NUTS 2 (freight) and NUTS 3 (passenger) databases are too large. A finer area resolution is needed for transport analysis and transport project appraisals.

*ETIS-BASE. ETIS (European Transport Policy Information System) is an information system of integrated policy tools to support policy analysis and policy making. It comprises four elements: a data element, an analytical modelling element, GIS and a final element interfacing users with the above elements. The primary goal of ETIS is to provide policy makers and policy analysts with the capability to include the European dimension in monitoring developments relevant for transport and transport policy. The formation of ETIS has been subdivided into three tasks, viz. ETIS-LINK, ETIS-AGENT and ETIS-BASE. The pilot version became available 2005. ETIS is focusing on the TEN network.

* The Task Force on Information and Data Cooperation (TFIDC) has suggested a Barents Transport Database and Portal for communications and transport**.** The core members of the TFIDC represent major Barents projects. The task force has decided to establish a road transport database, and development of such a proposal has begun. The work will continue and a draft will be established in mid-August 2005.

None of these ongoing, or planned, actions will consider including all of the specific demands in the Barents Region. Therefore, the need and demand for a Barents Transport Analysis Tool (BTAT) and a Barents Transport Database (BTD) will be presented below together with a proposal for such development program.

2. Needs and demands for a specific Barents Transport Flow model

The national transport models are only somewhat useful, at present, in analysing the cross border and specific Barents region regional transport flows.

Existing models mainly focusing on generalized time and cost will not cover the specific situations dealt with in the Barents region.

There is a need for a model capable of handling specific situations in the region, such as:

-Seasonal variations

*Seasonal variations in maintenance

*Seasonal flows, such as for winter and summer tourism

*Delays during bad winter conditions, such as snowfalls, slippery roads, reconstructions of roads, bridges, etc.

* Risk of closed roads related towards adverse climate conditions, slippery surfaces, ...

* Risk of closed roads related towards natural disasters such as landslides, ...

-Loose networks

*Alternative routes for hazardous goods

*Alternative routes for large (wide/high goods) vehicles

*Alternative routes for time sensitive goods, such as perishable food products, … .

-Countries with different development and political backgrounds

*Rules and legislations

*Tariffs

*Different road taxes

*Road pricing

*Fuel duties

*Taxing the use of national resources

*Economic development differences

*Neglected long term maintenance

*Delays in crossing borders/“customs delay” Especially No/Fi/Ru

*Veterinary control of food from Norway to EU

*Formal regulation regarding permitted loads, dimensions, …

-Special destinations

*Destinations of special interest for tourists

-type of tourism

-tourist volumes

-available transport modes to the destinations

* mines

-Handling of goods

*Freight terminals, distribution centres and warehouses are very important nodes in a logistic chain from producers to consumers. Further analysis regarding the functions and costs involved with stock, transfer costs and times and reloading/loading capacities are needed:

-size of shipment (consignment size) for different modes and commodity groups.

-most important commodity (group)

-type of company (producer, wholesaler)

-costs regarding stocking, handling, terminals, transport.

-commodity characteristics (bulk, piece goods, unitized, value, volume, weight, damage.

-mix of commodity

-annual volumes and seasonal variations.

- vehicle sizes

-type of load carrier

-Load factors

-delivery frequencies

-customer demand

-reliability in delivery on time, without damage, …

Summary

Some of those specific factors should be of interest to investigate further and to include in the development of a specific STBR database and transport model. For instance, they should include data and analysis possibilities of important bottlenecks, such as

-physical conditions
-nature related conditions
-traffic related conditions

The bottlenecks can also be binary (on-off) or gradual. Their character can be occasional, stop short, etc. Other examples of bottle-necks are ferries, narrow roads (<6m, < 7 m combined with other aspects), short horizontal radius (r<50m, <150m combined with other aspects), inclinations (>3% over 2km, >4% over 1km and >6% over 500m), Free height (<4,3m), and different bearing capacity < 3t, 6t, 10t, are examples of what should be included.

Because difficulties exist in obtaining data from terminals due to their fear of exposing commercial secrets, there is a great need in the region for a substitute such as synthetic data.

3. Needs and demands for a Barents Transport database

Information is lacking in existing databases. A database with more capabilities needs to be developed, not only for transport authorities, but also for other authorities, such as municipal and regional spatial planning authorities and different enterprises in forestry, trade, etc.

Experiences from ongoing projects briefly show the specifications for a future database:

* GIS based to permit access to use the data in different software for different analyses.

*Interface towards existing national and international databases to support the use and exchange of data at both the national and the regional levels and also across national borders.

*Interface towards national transport flow models to support the use of the data in different national and international analyses and project appraisals.

*Capability to handle future estimated through flows, such as proposed transport between China and the USA through the Barents region.

*Inter modality and connection between different transport modes.

*Related towards the ETIS database and its future development in supporting a joint database throughout the entire EU and its neighbouring countries.

*Overcome the lack of transport data from neighbouring countries

Even though there is a recent published report about the basic methodology used to compile Community statistics on the trading of goods in the EU, some aspects still have to be developed to fulfill the specific needs in the Barents Region. The report also provides some information on the differences between EU statistics and those published by Member States and international organizations that has to be discussed further. The 2005 Edition considers the new Intrastat legislation, EU enlargement and the new free dissemination policy of the European statistics. Future changes should also be considered.

The most important data for analysing the transport of goods is the “not easily available” information concerning the collection and distribution of different commodities. Many different operators without the support of computer based planning and scheduling manage distribution. Most information is therefore company secrets. Information about transport by the final user is generally also excluded.

A detailed study of the flow of different commodities (distribution and collection) should be carried out to support the development of a database.

Summary

The Barents transport database should be based on a structure that integrates it with the national databases in Sweden, Norway, Finland and Russia. The database should be essentially a virtual database based on existing databases.

The database should include traditional data and data from the STBR project and other important data to be defined later:
-traffic flow data (road, rail, air, sea), including data for transit traffic to other regions
-infrastructure data, information on traffic links (basic characteristics and condition).
-information of traffic nodes (terminals, border crossings, ports, airports).
-operational data (bottlenecks, problems, legislation, tariffs, etc).
-socio-economic data (population, employment, etc).
-other spatial data of importance for STBR, such as environmental data.

The database should become a knowledge base and therefore, also include reports and study results from the region. The use of data from the database and results from any analysis based on the data should also be included in the knowledge base.

Establishing the database should start with the road infrastructure and include the infrastructure for other transport modes later on. The database has attractive enough so that everybody will want to join it and supply it with data, and know that they too will get good results when using the database.

Institutional changes to support the exchange of data will probably be necessary. The copyrights are important considerations and should be based on the findings in the EU discussions from the INSPIRE project.

4. Description of the benefits for a Barents Transport Flow model/database

The benefits of using existing transport flow models from the region are mainly based on the experiences from using the models for domestic comparisons of different objects in the investment planning process.

The software used for these analyses can be grouped into two different categories:
-GIS based such as TransCad and ArcGIS with extensions and -Non GIS based such as TRIPS, EMME and STAN. This software is included in the different national transport models, such as the Swedish models SAMGODS and SAMPERS, and in other models, such as Trans-tools (European transport model).

Examples of what a new tool should be able to do are listed below in three categories.
-Operational needs and demands for a model/database within transport authorities:

*Intermodality for passenger/ freight (as National and European transport policies seek to promote intermodality through different measures)
*Inclusion of intercontinental flows (mainly for freight), as some models do not cover this segment
*Logistics/freight chain explicitly included
*Demands from future exploitation of oil/natural gas.
*Risk analysis of disturbances in transport systems for different branches.
*Effects of changes in a neighbouring country (Such as the changes in Kvarken sea transport on the transport in Northern Norway).
*Analysis of harmonizing maximum load
*Analysis of road/railroad infrastructure for very heavy transports

-Usefulness among the regional authorities

*Possibilities to integrate cross-border issues
*Land use - transport system analysis
*Transit flow analysis
*Future expectation of oil/natural gas exploration and its consequences on infrastructure.
*Tool for analysis of different scenarios and strategies for different development phases
*Welfare risks.
*Alternative options for development of land use and infrastructure
*Changes in transport subsidies

-Usefulness on national level

*Reduce differences between different national models.
*Easier evaluation of objects with or without cross-border flows.

Summary

A new database will make it easier to include cross-border issues in a different analysis. Data about the specific conditions can also be easily retrieved and used in a different analysis.

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A new transport model will increase the competitiveness of the region. A model based on the specific needs in the Barents region is a better base for analysis and prioritisation of investments among different objects in each of the participating countries.

5. Suggestion for development of a Barents Transport Flow model/database

A Barents Transport Flow model and database should be developed based on the existing national models in Sweden, Norway and Finland.

The specific modules, or adoptions of existing modules, for each existing national model and database content of special interest in the region should be developed in a cross-country organised project.

The process should be based on the following structure.

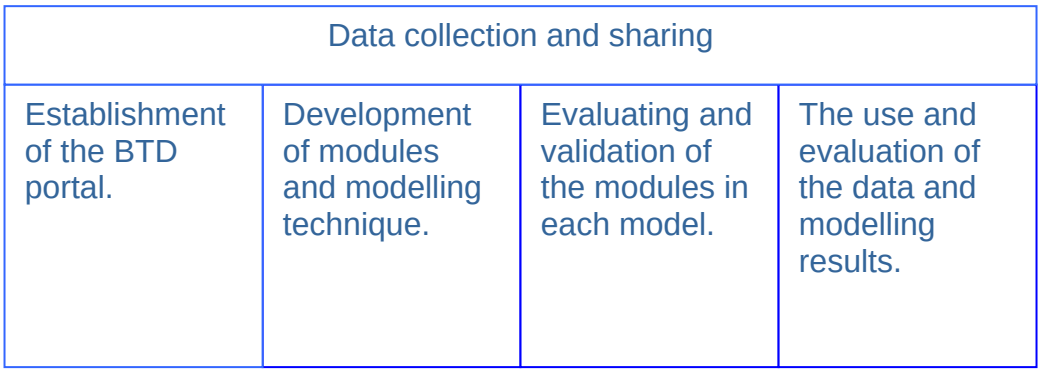

Figure 2. Project structure for the development of Barents Transport Analysis Tool and Database.

The alternative for the structure of a database is dependent on how it is supposed to be used and maintained. Below, an alternative architecture is presented.

ARCHITECTURE CHOICE ACCORDING TO THE OBJECTIVES OF THE DIRECT PROJECT (From DIRECT, Final Summary Report)

Application field		**----------Chosen architecture----------**		
		Local database	**Distributed objects**	Intranet/internet architecture
Transport Planning		**Best choice**	Bad choice	Good choice if a light product is selected (ex Oracle WebDB)
Traffic Manage-ment	Traffic information[1] (aggregated demand)	Bad choice	**Best choice**	Good choice, but implies a very powerful configuration
	Traveller infomation[2] Trip planning[3] (individual demand)	Difficult to publish the data, low scalability	Good choice, but implies high development costs, and a web interface	**Best choice**

Internet/intranet architecture is preferable to be able to combine the use of a database. The best solution in the Barents region should be based on Internet architecture with distributed responsibilities for each country's participating representatives for the upgrading of information.

5.1 "Barents Transport Database (BTD)"

Structure of the database should be compatible with:

*NVDB (National road database, Sweden)
*NVDB (National road database, Norway)
* … (Finland)
* … (Russia)

The database should be including both static data and dynamic data such as:

Network structure

- Road networks
  - Ferries
  - Freight terminals
- Rail networks
  - Stations for passengers
  - Terminals for freight
- Airports
  - Air network
- Inland waterways
- Maritime transport
  - Harbours

Industries that are terminals in themselves
….

-Interconnections between different transport modes.
-Heavy and big transport network

And also dynamical data such as:

Seasonal variation in climate,
Seasonal variation in maintenance
…

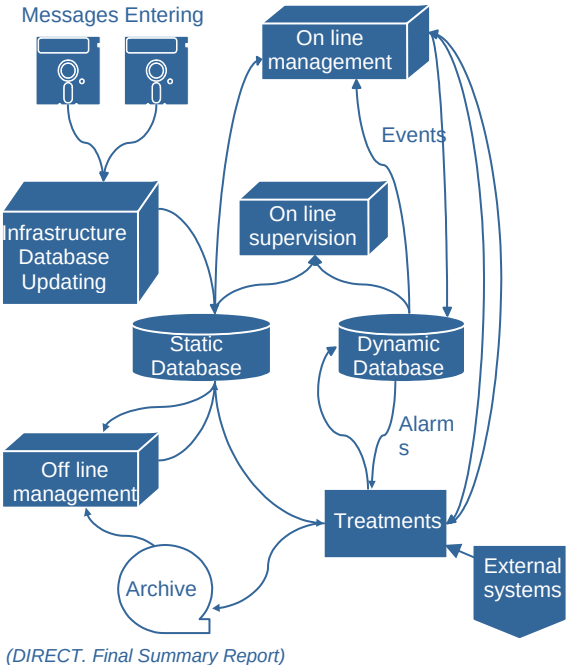

Figure 3. General conceptual model of the database considering the integration of both static and dynamic data.

A Barents Transport Database (BTD) shall be established as an Internet portal available through Internet and be a copy of existing databases and not only a link to existing databases. (Existing databases are, on a detailed level, only available via intranet in each of the organisations.)

The development of BTD shall be made in three steps, briefly described below:
1. Existing data are made available from the participating countries. Metadata and translations of definitions are also made available. Copyright issues have to be managed.
2. The definitions are developed to establish a common structure of data.
3. Harmonising of data. New standards are established.

Synthetic data should also be developed where necessary.

5.2 "Barents Transport Analysis Tool (BTAT)"
The principal structure for a Transport flow model should include:

-Input /import facilities to existing models in the region
*SAMPERS / SAMGODS / NEMO / …

-Output/export capabilities (both in GIS-based format ArcGIS/MAP-Info and other formats) of software used in the participating countries
*HDM-4
*EVA
*Effekt 5
*to regional planners
*export O/D matrices to national bases
*graphical format (TIF, EPS, …

-Modules to be included
*Standardised slide formats for presentation of data
*Easy graphical output production/visualizing of data and results
*list of "indicators"

The development of the BTAT shall be made as complementary modules to the already existing tools used in each country. The specific Barents functionality shall be made jointly. The development of the complementary modules will then be made for each national model in the Barents region.

A specification of a logistics model, as part of the Norwegian and Swedish national freight model systems, was studied in 2004. Such modules should also be included to be able to manage the logistics in the analysis.

In particular, seasonal variations should be of importance to analyze.

Also opportunities to create scenarios, and analyze the consequences of such scenarios, are of importance. Cross border transport flow analysis, especially with specific consideration to the Barents region conditions shall be included.

6. Organisation and financing

6. 1 Organisation in brief

A separate organisation in the project will have the responsibility to establish the database.

Web accessible data shall be made available by links to already existing data providers. Access to data presently only available on the intranet should be included. Copies of existing databases of importance to the Barents region shall be made available on a special server for the BTD.

Participating authorities should be made responsible for updating and maintaining the existing databases and the model. Updating shall be made by copying the existing databases to the BTD server during decided intervals.

A separate organisation in the project shall be responsible for updating and maintaining the specific database for the Barents region.
The project should be organised to include different participants, though the project will start by focusing on road transport. The project should be organised by participants from national and regional road authorities, regional authorities, railroad authorities, civil aviation authorities and other participants such as SIKA could be included.

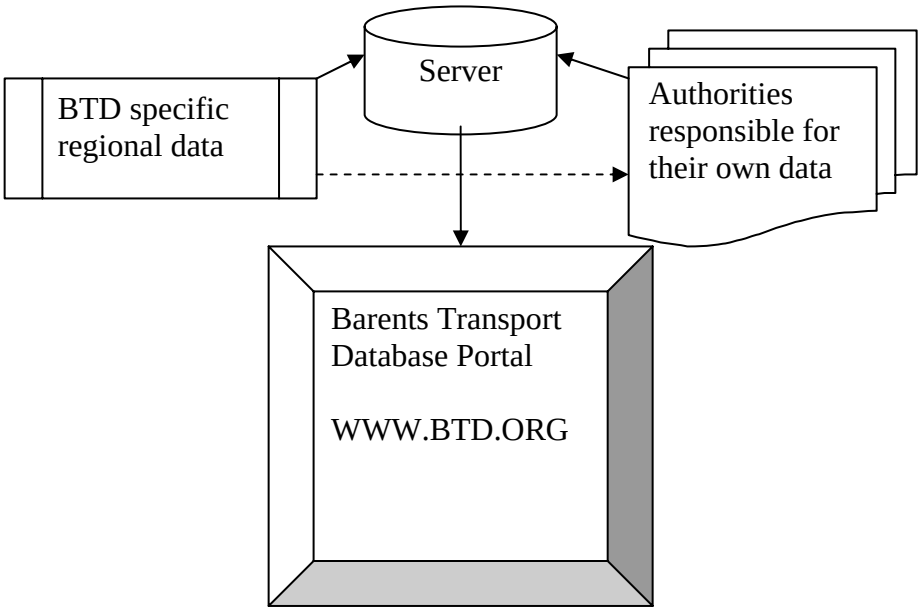

Figure 4. Structure of the Barents Transport Database.

6.2 Time schedule and deliverables.

The project should start with a seminar with academics and authorities to discuss the need for analysis and the knowledge to be used in the establishment of BTD and BTAT.

Step 1 Establishment of a Barents Transport Database (2006-2010)

Step 2 Establishment of a Barents Transport Analysis Tool (2007-2010)

Infrastructure data and dynamic data for freight transport and Freight flow modules will be developed 2006-2009. Infrastructure data and dynamic data for passenger transport and passenger flow modules will be developed 2008-2010

Suggested deliverables shall be:

WP1 Specification of data for a Barents Transport Database (BTD) for freight transport analysis

WP2 Specification of data for a Barents Transport Database (BTD) for passenger transport analysis

WP3 Establishment of a Barents Transport Database (BTD)

WP4 Gap analysis of existing transport analysis tools and specification of the analytic modules to be included in a Barents Transport Analysis Tool (BTAT) for freight transport.

WP5 Gap analysis of existing transport analysis tools and specification of the analytic modules to be included in a Barents Transport Analysis Tool (BTAT) for passenger transport.

WP6 Development of analytical modules for freight transport in each national transport model (SAMGODS / NEMO / …) in the Barents region. (Coordinating and management of the development of the modules are included.)

WP7 Development of analytical modules for passenger transport in each national transport model (SAMPERS/ …) in the Barents region. (Coordinating and management of the development of the modules are included.)

WP8 Validation of the developed freight transport analysis modules in the Barents Transport Analysis Tool (BTAT)

WP8 Validation of the developed passenger transport analysis modules in the Barents Transport Analysis Tool (BTAT)

6.3 Budget for set up and operation

Adapting the project volume to different financial situations should be possible.

A first step should be to start a Barents transport data portal. Setting up a portal on a separate server and retrieving data from participating authorities could be managed with a reasonable amount of work and a reasonable cost. A good beginning would require a few months of work.

Identifying specific Barents region data, establishing such data and developing specific modules in the national transport models based on the regional demands can be expensive. The budget for development of such modules should be made in collaboration with the participating authorities.

6.4 Financing plan

The finance plan should be divided into two parts:

1. "Independent"
Participating National Road Authorities should finance the initial project with the establishment of a portal that focuses mainly on using existing road transport data because they could gain direct benefits from such a portal.

Expansion by using other already existing data could also be financed by different authorities.

2. Extended plan to be EU funded, for instance, with Interreg IV

The development of specific Barents data and the identification and development of specific flow model analysis tools should be EU financed. Such identification and model development can possibly be also valuable to other EU regions with similar, or other regionally specific, conditions and modeling demands.

7. Discussion/Conclusions

The specific conditions in the Barents Region require, for instance, specific transport flow analysis. There is a need to develop a Barents transport flow model and database. Such a database can initially be established as an Internet based portal with access to already existing data. The development of specific Barents region data and development of specific analysis tools should be financed by the EU and participating authorities.

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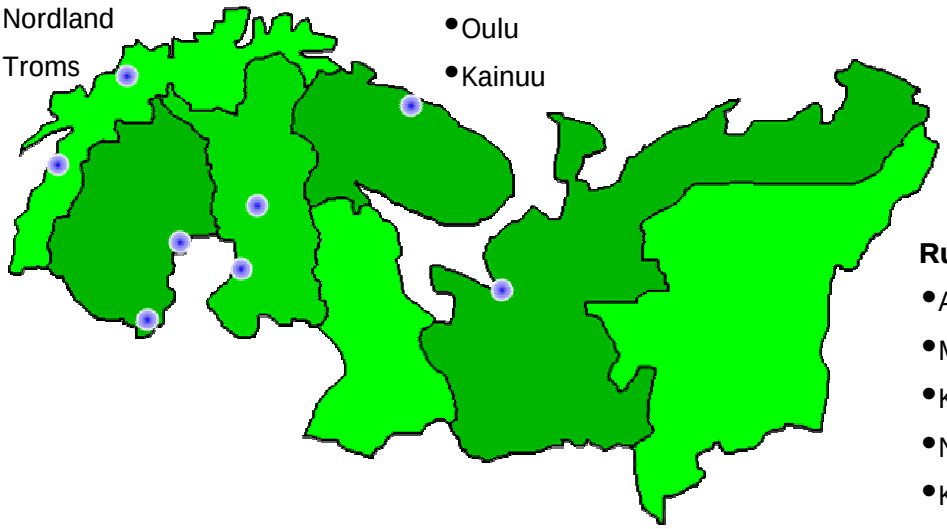
Appendix 1

The Barents Region Administrative Areas

Norway:
- Finnmark
- Nordland
- Troms

Sweden:
- Norrbotten
- Västerbotten

Finland:
- Lappland
- Oulu
- Kainuu



Russia:
- Arkhangelsk
- Murmansk
- Karelia
- Nenetsia
- Komi

More information on STBR – Sustainable Transport in the Barents Region:

STBR Homepage
http://www.barentsinfo.org/stbr/

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